Modeling Human Body Exposure to the field emitted by a Vehicular Antenna

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This abstract studies the scenario of a human body exposed to electromagnetic fields generated by a vehicular antenna working in the frequency range [2 – 30] MHz. In particular, the goal is to deepen knowledge for the exposure in terms of both induced electric field and SAR in a military operator (i.e. Duke, ViP, v.3) standing partially outside the vehicle.

Nowadays, in military practice there is a growing use of electromagnetic technologies to satisfy diverse operational needs that range from high-rate tactical links to broadband jammers [1]. This implies the use of vehicular antennas that transmit high powers, in more than one frequency band (e.g. HF, VHF, and UHF), potentially exposing crew personnel to high electromagnetic (EM) exposure [1]. IEEE Technical Committee 95 (IEEE-TC95) proposed a standard whose purpose is to provide exposure limits to protect the personnel in a military workplace [2]. The International Commission on Non-Ionizing Radiation Protection (ICNIRP) indicate recommendations about the health and environmental protection to non-ionizing radiation exposure, both for workers and the general population [3]. Two kinds of exposure limits are recommended, based on thermal short-term effects: basic restrictions, closely related to radiofrequency-induced adverse health effects (i.e. electric field strength and/or the specific absorption rate (SAR) according to the frequency range of interest) and reference levels, derived from the previous ones to provide a more-practical way of demonstrating compliance with the guidelines. Reference levels can be overcome, providing that basic restrictions are respected [3].

With the aim of protecting the crew against high-power EM radiation, this research is devoted to the computation of the induced electric field and SAR from a HF vehicular antenna. A computational model that represents the best compromise between accuracy and efficiency is proposed for this aim (see Fig. 1.A). This can be challenging and complicated due to the human body typical dimensions with respect to the vehicle structure complexity and antenna’s wavelength in the band [2 – 30] MHz. The exposure scenario was simulated in Sim4life (v.4.4, Zurich MedTech) at 16 MHz, as central frequency in the band of interest. All the estimated quantities resulted well below the imposed limits as shown in Fig. 1.B for the E field for an antenna input power of 25 W.

Fig 1: (A) Computational Model of the vehicle, operator, and HF Antenna, (B) E field map in the operator for an antenna input power of 25 W

References